84-001186/01 B07 S05 P34 P42 BERN/ 09.06.82
BERNAZ G *EP --96731-A
09.06.82-EP-810245 (28.12.83) A61m-11 A61n-01/04 B05b-01

Applicator for cosmetic and electro-therapeutic skin treatment - has handle contg. sponge, spray and electrode flexibly coupled to supplies

CH1-000276 D/S:AT BE CH DE FR GB IT LI LU NL SE.

The front end of the applicator handle has an integral cup, open towards the front. An electrode is sandwiched between the inner end of the cup and a sponge which projects slightly beyond the open end of the cup.

A spray nozzle in the centre of the sponge has its supply passage extending through the electrode. The handle is connected by a flexible pipe to a pressurised supply of liq.

Pref. the spray nozzle screws into a tapped bore in the handle. The bore leads into premix passage piped to received liq. and gas. The premix chamber opens laterally through the handle surface to accept a trigger or button operated valve controlling flow to the spray nozzle.

USE/ADVANTAGE

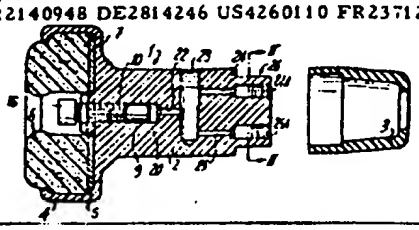
For cosmetic and electrotherapeutic treatment of a patients skin. The applicator no longer requires electrode and handle to be coupled together immediately prior to use. The spray pattern is more consistent than with two-part applicators.

DETAILS

Aq. lotion and compressed air are premixed (23) and delivered via a spray nozzle (16) centred inside an applicator sponge.

The sponge is electrically charged by a metal washer (7) wired (8) to an electric supply to form an electrode. A rubber safety cup (3) sleeves the joint between the handle (1) and a flexible pipe contg. liq. gas and electric supply lines.(15pp448DAHDwgNo1/5).

(F)ISR:CH-625959 FR2400370 DE2411389 US4014345 FR2140948 DE2814246 US4260110 FR2371238 FR2399282.



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910 West Avenue, Austin, Texas 78701 USA

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EUROPEAN PATENT OFFICE
EUROPEAN PATENT NO. 0,096,731 A1

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APPARATUS FOR AESTHETIC AND ELECTROTHERAPEUTIC CARE AND ATOMIZATION DEVICE

Inventor:	Gabriel Bernaz 35, rue E. Marziano CH-1227 Caroque Switzerland
Applicant:	Gabriel Bernaz 35, rue E. Marziano CH-1227 Caroque Switzerland
Representative:	Mohnhaupt, Dietrich et al. Dietlin, Mohnhaupt & Cie. 3, quai du Mont-Blanc CH-1201 Geneva Switzerland

[Abstract]

The apparatus is made up of a supply circuit and distribution handle (1) connected to the circuit by a flexible multi-function tube, via a quick-release coupling. The handle is formed by body (2), head (4) and cap (3), the body and the head being of one piece. Head (4) forms reservoir (5), in which are housed at least one electrode (7), toroidal sponge (6), and centrally, atomization device (10). This atomization device has pre-mixing chamber (20), at least one longitudinal channel (18), anterior turbulence chamber (21) and central opening with clean edges (17).

The invention relates to an apparatus for aesthetic and electrotherapeutic care for cutaneous and transcutaneous treatment. It also relates to a device for atomization or spraying of a liquid.

The result of the care given by the apparatus is to a great extent due to physicochemical and electrodynamic effects created by an electric current applied to the skin. A chemical-cutaneous reaction results.

Swiss Patent No. 625659 describes a device for aesthetic and electrotherapeutic care which has at least one electrode and a handle which is separate from this electrode, the handle and the electrode having some means of coupling in order to attach the electrode in a removable manner to the handle, and allowing the handle to provide the electrode with a voltage and/or current and at least one fluid as required.

According to this patent, the coupling of the electrode to the handle is done by a rapid coupling connection, the electrical connections being brought about by one or more plugs which must be inserted into corresponding sockets or jacks of the handle. At the same time, a cavity is formed in which a gaseous fluid, normally air, and a liquid fluid, generally water, can be mixed in order to form a spray when the mixture which is formed passes through a tube formed centrally at the bottom of the electrode carrying piece. This piece moreover has a positioning finger which must be inserted into a blind hole of the handle.

This construction of the handle has been observed to have a number of disadvantages.

First, the user often finds it difficult to position the electrode carrying head correctly with respect to the handle in order to connect these two components. The positioning finger as well as the electrical connection plugs may be misaligned and then no longer enter their holes or jacks located in the handle. Furthermore, the formation and the quality of the spray leave much to be desired, partly due to the fact that the shape of the mixing cavity differs depending on whether or not the electrode carrying head was pushed thoroughly into the handle.

The invention aims to lessen or eliminate these disadvantages. Its purpose is to propose a new, more reliable and solid construction of the handle, which is easier to manipulate during use. Another purpose of the invention is to develop a new atomization device that is capable of giving

a perfect spray, with ultra-fine droplets, requiring only a minimum of air for suspension and propulsion. In effect, the function of the spray is mainly to wet the electrodes and the skin; the liquid is generally an aqueous lotion containing substances for cosmetic or pharmaceutical treatment of the skin. The air is only necessary for forming a good spray and, if applicable, to convey ozone. Excess air is therefore unnecessary and should be avoided. The known atomization device constructions were unable to fulfill these aims.

The atomization device and the apparatus according to the invention are defined in the independent claims, while the particular implementations are dealt with in the dependent claims.

The invention will be explained in more detail through the following description of some embodiments given as non-limiting examples of the device and of the apparatus according to the invention, and with the aid of the drawing in which:

Figure 1 is an axial section of a handle which is part of the apparatus according to the invention,

Figure 2 is a cross section along line II-II of Figure 1,

Figure 3 is an axial section of the atomization device according to the invention, in the unscrewed state,

Figure 4 is an axial section of the front part of another handle, and

Figure 5 shows the block diagram of the apparatus according to the invention.

Handle 1 represented in Figure 1 has a round exterior section and is preferably manufactured from an insulating synthetic material which is moldable, hard, and has good dimensional stability; for example, nylon, hard polyvinyl chloride or polyvinylidene chloride, including the[ir] copolymers, polycarbonate, polyacetal, etc. Main body 2 has, at the front part, head 4 entirely formed with body 2. This head 4 has reservoir 5, with a front peripheral re-entrant edge, bearing annular sponge 6 with open pores which rests against the lateral walls of head 2 and at the bottom of reservoir 5, against disk 7, made of a corrosion-resistant, electroconductive material. A wire (not represented), tightly connected from behind disk 7, passes through channel 8 (see Figure 2) made in body 2 of the handle and connects disk 7 and, by contact, electrically connects sponge 6 to the housing of the apparatus as will be described below. The disk can be made out of a lead-tin alloy, stainless steel or a conductive material which is not very corrosion resistant but which is covered with a resistant coating.

The volume and dimensions of the sponge 6 are chosen so that it projects form the front of reservoir 5 while being retained by the peripheral edge.

Handle 1 has central bore 9 in which atomization device 10 (described in more detail below) is screwed. The length of device 10 and of bore 9 are chosen so as to form pre-mixing chamber 20 at the bottom of the bore. Bore 9 is extended axially by circular channel 22 to blind

lateral hole 23 which is used to receive a valve-plunger which controls the entry and cutoff of the fluids forming the spray.

Channels 24 and 25 are drilled in the rear part of body 2 and end in blind hole 23, on the one hand, and in the rear surface by threaded bore 24A, 25A, on the other hand. These bores 24A, 25A are used to receive a screwed connector with a flexible tube (not represented) which leads to the housing of the apparatus. Channels 24 and 25 are generally symmetrical with respect to a vertical plane including the axis of the handle, and channel 24 is provided for water, and channel 25 for air.

Finally, these water, air and electrical connections are covered and protected by cap 3 which fits on the rear part of the handle which has narrowing 26.

One sees that handle 1 has a solid, rigid and sturdy single-piece construction and that there are no pieces which must be connected or fitted together or even positioned by the user who wishes to use the apparatus.

Figure 3 shows the atomization device according to the invention, which is used with the apparatus which has just been described but which can be used, independently from it, for any uses in which one must produce an ultra-fine, regular spray requiring only a minimum of air as propulsion fluid. It can be used in particular in any of the known aerosol cans.

Device 10 has cylindrical main body 11, arranged for being screwed in a bore by means of external threads 12 and nut 13; however, this fastening means can be replaced by another, equivalent means, depending on the particular case; the expert in the field is familiar with these fastening devices.

The front part of body 11, on the left in Figure 3, has circular edge 14, approximately 0.1 to 0.2 mm and typically 0.11 mm high, and external threads 15. Cap 16 is screwed on these threads 15 to the point that its flat interior surface comes in contact with the anterior boundary of edge 14. Turbulence chamber 21 is thus formed inside of cap 16. Opening 17, whose diameter is suited to the desired spray flow rate, is made in the front wall of cap 16. Its diameter, which determines the form and flow rate of the spray, is, for example, 0.35 mm for the use referred to in particular here. However, by a simple and rapid test, the expert in the field can find another diameter suited to another flow rate and/or to other dimensions of the device.

It is very important for the circular edges of the opening, in particular the internal edge, to be clean and well-defined and for the cylindrical wall of the opening to form a 90E angle with the two flat, parallel surfaces of the cap, that is, for the opening to be cylindrical in the axis of the device and with no rounded or burred edges. These conditions are important for the spraying of the liquid.

One, two or more channels 18 connect the turbulence chamber to the rear end of body 11. They are used for passage of a pre-mixture of liquid and air coming from pre-mixing chamber 20

that is located behind device 10 (see Figure 1). The diameter and the number of channels 18 are such that a pressure difference is created between the two chambers 20 and 21. There are two channels 18 in the embodiment represented, each having a diameter of 0.8 mm. But one channel is sufficient in principle; it must not be located along the axis of the device.

When used to form a spray, chamber 20 is supplied, according to Figure 1, with air and water via channel 22. The pressure of the water and of the air which enter bores 24A and 25A, respectively, can reach a few bar; in the chosen example, it is approximately 0.4 bar. A first mixture of water and air, in a more or less laminar flow, is formed in circular channel 22 and in pre-mixing chamber 20. The final mixture is formed in the turbulent state in chamber 21, and a perfectly stable spray with extremely fine and regular droplets exits opening 17. The angle of opening of the conical spray is 5-30E depending on the length-to-diameter ratio of opening 17. The water flow rate is approximately 15 to 20 mL/min; the air flow rate is very low and probably less than 100 mL/min.

The atomization device is screwed from the front in bore 9 of handle 1. It can therefore be easily removed and cleaned or replaced.

Sponge 6 is soaked with the liquid of the spray in order to ensure the conductivity between disk 7 and the skin of a patient on which the handle is applied.

Figure 4, through an axial cutaway section of the front part of another handle 1A, shows the use of a multiple electrode. Reservoir 5 of Figure 1 is subdivided by vertical walls into two, three, or four reservoirs 5A with re-entrant edges, each having cylindrical sponge 6A and flat metal electrode 7A; each electrode is connected by a wire (not represented) with the housing of the apparatus which will be described below. This configuration makes it possible to run a current between two or more poles 7A of reservoirs 5A through sponges 6A soaked with liquid, and the skin of the patient. Several different voltages can then be applied.

Figure 5 represents the functional diagram of the apparatus according to the invention.

Circuit 35 has constant DC current source 36 and pulse generator 37. These pulses are normally rectangular in shape; the apparatus enables one to regulate the duty ratio of the pulses as well as their sequence; that is, it is possible to alternate a train of pulses with no pulses. Furthermore, the frequency of the pulses can be adjusted independently from the duty ratio.

Switch 38 makes it possible to choose these currents and to apply them to the input of amplifier 39 whose output is connected to wires 50 and 51. Circuit 35 also has electronic pump 40 which draws air through filter 41. The compressed air passes through ozone generator 42 and heating element 43 whose output is connected to one of the flexible tubes supplying handle 1.

The air pressure is also exerted above the surface of liquid or aqueous lotion 44 found in container 45. The liquid under pressure passes through flow regulator 46 into the other flexible supply tube of handle 1. The flow rate of the air that enters can also be controlled by a regulator.

The handle is connected to circuit 35 by a quick-release coupling which is already known and is not represented.

Valves 47 or electrovalves make it possible in certain cases to short circuit electronic pump 40; a bottle of oxygen or air under pressure can then supply the apparatus.

During use of the apparatus, the patient touches a return electrode, called inactive electrode 52, which is connected to amplifier 39 in circuit 35 by means of wire 53.

The voltage applied to the patient therefore varies, namely the zero level can change according to the bioelectric characteristics of the patient.

Thanks to the apparatus described and represented, it is possible to deliver a vast range of care, wherein one or more distribution handles cooperate with a certain number of electrodes, and a single opening, and wherein it is possible for the handles to be interchanged rapidly. For each electrode, one has all the resources of the electromechanical means. For example, it is possible to use the single pole electrode in such a way as to deliver pulses and a spray simultaneously, or it is possible to use a two-pole electrode so as to deliver a DC current and a spray.

Besides the easy operation and the reduction of the spatial requirements, the device described and represented has a relatively low cost. In effect, by grouping several electrical functions, there is need only for one power supply, for example.

The apparatus according to the invention can be modified within the scope of what is claimed. For example, the shape, the frequency and the amplitude of the current applied to the patient by the handle can be different from that described here. Furthermore, the shape of the handle can be suited to the care or treatment requirements envisioned.

A preferred modification consists of the execution of a system for drawing of the liquid applied in spray form to the skin of the patient and to the sponges. In effect, it can be problematic if there is an excess of liquid on the skin.

This system, which is not represented in the drawing because it can be easily executed by the expert in the field, includes a channel passing through the handle in the lengthwise direction and ending in reservoir 5. This channel is connected by a flexible tube to a second electronic pump head, through a separation container. The electronic pump can therefore draw in the excess liquid and recover it. This aspiration can be triggered continuously or intermittently.

Claims

1. An apparatus for aesthetic and electrotherapeutic care, which has a handle for distribution of voltage and of a spray, characterized by the fact that the handle integrally contains a reservoir in which at least one active electrode is mounted and a sponge for transmitting the voltage of the electrode to the skin of the patient, and at the center, a device for spraying of a

liquid, this atomization device being surrounded by the electrode or the electrodes, the handle being connected by a flexible tube to an opening containing the supply in terms of fluid flow.

2. The apparatus according to Claim 1, characterized by the fact that the atomization device is screwed in a central bore of the handle so as to form a chamber for pre-mixing of the fluids inside the bore that is connected at the bottom by a channel to the cavity of a valve controlling the admission of a gas and of an aqueous liquid under pressure.

3. The apparatus according to Claim 1 or 2, characterized by the fact that the flexible tube connecting the handle to the circuit has two channels for a gas under pressure, an aqueous liquid under pressure, and for each active electrode, a supply cable.

4. The apparatus according to Claim 3, characterized by the fact that the handle also has a channel for evacuation of liquid passing through the handle lengthwise between the reservoir and the other end, said flexible tube moreover having an evacuation channel connected in the circuit of the apparatus to the second head of an electronic pump, the first head being used to create the hydraulic and pneumatic pressures.

5. The apparatus according to one of the preceding claims, characterized by the fact that it has a group of several separate electrodes in the reservoir, each electrode being connected separately to a voltage source in the circuit.

6. The apparatus according to one of the preceding claims, characterized by the fact that the flexible tube is connected to the circuit by a quick-release coupling, by which different handles can be coupled to the apparatus.

7. The apparatus according to one of the preceding claims, characterized by the fact that the atomization device is supplied by air or oxygen and water or an aqueous lotion, the two fluids being under a pressure of approximately 0.4 bar.

8. The apparatus according to one of the preceding claims, characterized by the fact that it has an ozone generator connected in the flow path of air or oxygen.

9. A device for spraying of a liquid by means of a gaseous fluid under pressure, characterized by a cylindrical body whose entire length is traversed by at least one straight channel, parallel to the axis of the body, by a turbulence chamber on the front part of the body, the chamber being closed towards the front of the device by a front wall with planar and parallel surfaces containing a cylindrical central opening for formation of a spray whose generating line forms, with the two surfaces of the wall, an angle of 90Ewith no rounded or burred edges.

10. The device according to Claim 9, characterized by the fact that the front wall is part of a cap screwed on the anterior part of the body, the chamber being delimited laterally by a circular edge.

11. The device according to Claim 9 or 10, characterized by the fact that the number of channels and their diameter as well as the diameter of the central opening are chosen so as to

create a pressure difference between the turbulence chamber and the supply pressure upstream from the channels.

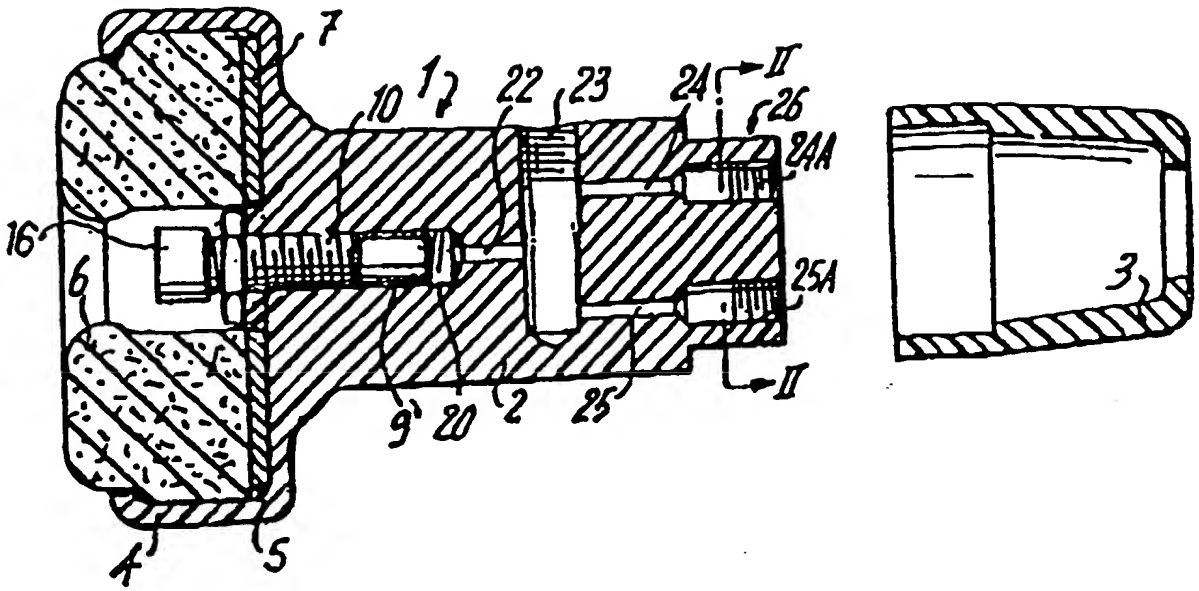

Figure 1

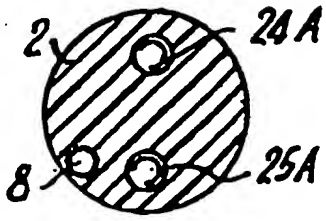

Figure 2

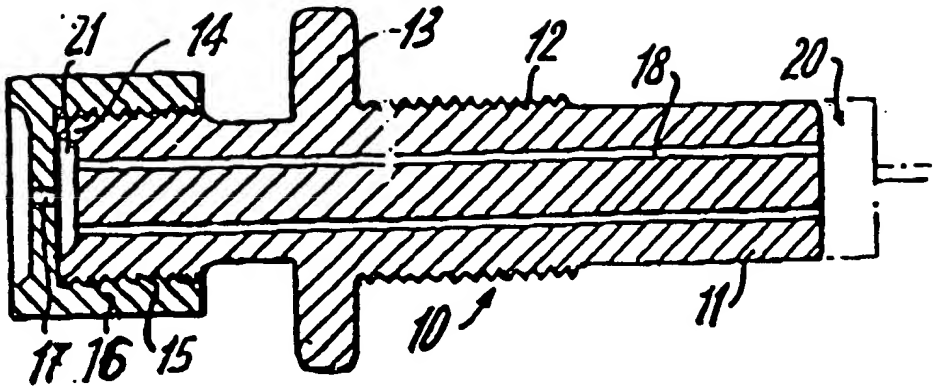

Figure 3

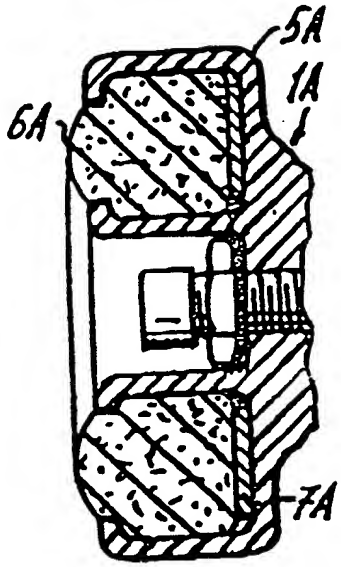

Figure 4

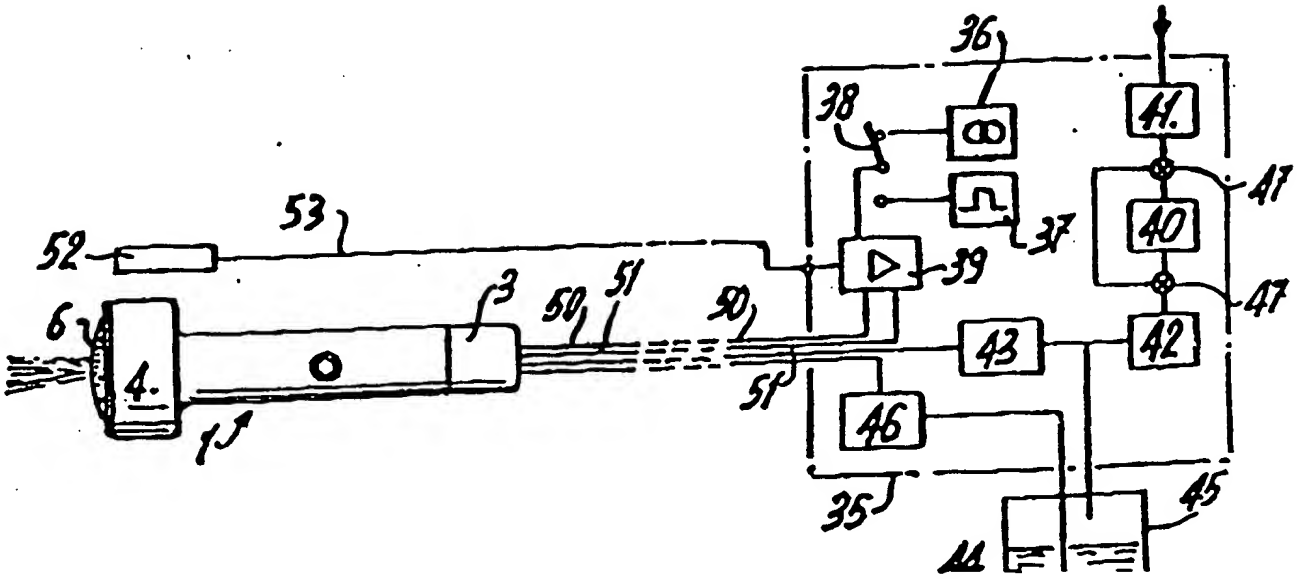

Figure 5

European Patent Office

Application Number
EP 82810245.9

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl³)
X	CH – A5 – 625 959 (BERNAZ) * entire document *	1, 3-7	A 61 N 1/04 A 61 M 11/00 B 05 B 1/00
A	FR – A1 – 2 400 370 (SOMATRON) * Page 1, lines 1-9; page 2, line 24 - page 3, line 17 *	1	
A	DE – A1 – 2 411 389 (NEMECTRON) * Page 6, lines 4-21; Figure 1 *	1,5	
A	US – A – 4 014 345 (KAMEY) * Abstract; Figure 3 *	1	
A	FR – A – 2 140 948 (BERTHOUD) * Figure 2 *	2,9-11	TECHNICAL FIELDS SEARCHED (Int. Cl.³)
A	DE – A1 – 2 814 246 (METALGESELLSCHAFT) * Page 6, lines 11-22; Figure 1 *	2,9-11	A 61 N A 61 M B 05 B
A	US – A – 4 260 110 (WERDING) * Abstract; column 1, lines 7-29; column 14, lines 12-58; Figure 4 * & FR-A-2 371 238 & FR-A-2 399 282	2,9-11	

The present search report has been drawn up for all claims.

Place of search	Date of completion of the search	Examiner
VIENNA	December 23, 1982	NEGWER

CATEGORY OF CITED DOCUMENTS

X: Particularly relevant if taken alone.
A: Technological background.
O: Non-written disclosure.
P: Intermediate document.

T: Theory or principle underlying the invention.
E: Earlier patent document, but published on, or after the filing date.
D: Document cited in the application.
L: Document cited for other reasons.

&: Member of the same patent family, corresponding document.

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~~HAND HELD~~ APPLICATOR FOR COSMETIC AND ELECTRO-THERAPEUTIC SKIN TREATMENT + HAS HANDLE CONTG. SPONGE, SPRAY AND ELECTRODE FLEXIBLY COUPLED TO SUPPLIES.

(43) Date de publication de la demande: 28.12.83
Bulletin 83/52

(84) Etats contractants désignés: AT BE CH DE FR GB IT LI LU NL SE

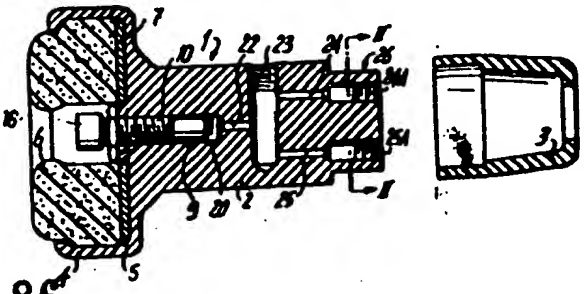
(71) Demandeur: Bernaz, Gabriel, 35, rue E. Marziano, CH-1227 Carouge (CH)

(72) Inventeur: Bernaz, Gabriel, 35, rue E. Marziano, CH-1227 Carouge (CH)

(74) Mandataire: Mohnhaupt, Dietrich et al, DIETLIN, MOHNHAUPT & CIE 3, quai du Mont-Blanc, CH-1201 Genève (CH)

(54) Appareil pour soins esthétiques et électrothérapeutiques et dispositif d'atomisation.

(57) L'appareil est constitué d'une base d'alimentation et d'une poignée de distribution (1) reliée à la base par une conduite multifonction flexible, via un raccord rapide. La poignée est formée d'un corps (2), d'une tête (4) et d'un capuchon (3), le corps et la tête étant d'une pièce. La tête (4) forme une cuvette (5) dans laquelle est logée au moins une électrode (7), une éponge torique (6) et, centralement, un dispositif d'atomisation (10). Celui-ci comprend une chambre de prémélange (20), au moins un canal longitudinal (18), une chambre antérieure de turbulence (21) et une ouverture centrale à bords francs (17).



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électriques étant réalisées par une ou plusieurs fiches qui doivent être insérées dans des prises ou douilles correspondantes de la poignée. Simultanément, une cavité est formée dans laquelle un fluide gazeux, normalement de l'air, et un fluide liquide, en général de l'eau, peuvent se mélanger pour former un spray lorsque le mélange formé passe par une tuyère pratiquée centralement au fond de la pièce porte-électrode. Cette pièce comporte en plus un doigt de positionnement qui doit être inséré dans un trou borgne de la poignée.

On a constaté que cette construction de la poignée comporte un nombre de désavantages.

D'abord, l'utilisateur trouve souvent difficile de positionner la tête porte-électrode correctement par rapport à la poignée pour raccorder ces deux organes. Le doigt de positionnement ainsi que les fiches de connexion électrique peuvent être faussés et n'entrent alors plus dans leurs trous ou douilles situés dans la poignée. En plus, la formation et la qualité du spray laissait beaucoup à désirer, en partie dû au fait que la forme de la cavité mélangeuse est différente si la tête porte-électrode était poussée à fond dans la poignée ou non.

L'invention vise à supprimer ou a atténuer ces inconvénients. Elle a pour but de proposer une nouvelle construction plus sûre et plus solide de la poignée, plus facilement à manipuler lors de l'usage. Un autre but de l'invention est de développer un nouveau dispositif d'atomisation apte à donner un spray parfait, a gouttelettes ultra-fines, ne nécessitant qu'un minimum d'air de suspension et de propulsion. En effet, le spray a prin-

cipalement la fonction de mouiller les électrodes et la peau; le liquide est généralement une lotion aqueuse comportant des substances de traitement cosmétique ou pharmaceutique de la peau. L'air est uniquement nécessaire pour former un spray correct et, le cas échéant, pour véhiculer de l'ozone. Un excès d'air est donc inutile et à éviter. Les constructions d'atomiseurs connues ne pouvaient pas remplir ces buts.

Le dispositif d'atomisation et l'appareil selon l'invention sont définis dans les revendications indépendantes tandis que des réalisations particulières font l'objet des revendications dépendantes.

L'invention sera expliquée plus en détail par la description suivante de modes de réalisation, donnés à titre d'exemple non-limitatif du dispositif et de l'appareil selon l'invention, et à l'aide du dessin dans lequel :

la fig. 1 est une coupe axiale d'une poignée faisant partie de l'appareil selon l'invention,

la fig. 2 est une coupe transversale selon la ligne II-II de la fig. 1,

la fig. 3 est une coupe axiale du dispositif d'atomisation selon l'invention, à l'état dévissé,

la fig. 4 est une coupe axiale de la partie frontale d'une autre poignée, et

la fig. 5 montre le schéma-bloc de l'appareil selon l'invention.

La poignée 1 représentée à la fig. 1 est de

section extérieure ronde et est fabriquée de préférence en matière synthétique isolante, moulable, dure et ayant une bonne stabilité dimensionnelle, par exemple nylon, polychlorure de vinyle ou de vinylidène dur, y compris les copolymères, polycarbonate, polyacétale etc. Le corps principal 2 comporte, à la partie frontale, une tête 4 formée intégralement au corps 2. Cette tête 4 comprend une cuvette 5, à rebord rentrant périphérique frontal, portant une éponge annulaire 6 à pores ouvertes qui s'appuie contre les parois latérales de la tête 2 et, au fond de la cuvette 5, contre une rondelle 7, en matériau conducteur de l'électricité et resistant à la corrosion. Un fil non représenté, relié solidement par derrière à la rondelle 7, passe par un canal 8 (voir fig. 2) pratiqué dans le corps 2 de la poignée et relie la rondelle 7 et, par contact, l'éponge 6 électriquement au boîtier de l'appareil comme il sera décrit plus bas. La rondelle peut être réalisée en un alliage plomb-étain, en acier inoxydable ou encore en un matériau conducteur peu résistant à la corrosion mais revêtu d'une couche résistante.

Le volume et les dimensions de l'éponge 6 sont choisis pour qu'elle déborde frontalement de la cuvette 5 tout en étant retenue par le rebord périphérique.

La poignée 1 comporte une alésage central 9 dans lequel est vissé le dispositif d'atomisation 10 qui sera décrit en détail plus bas. La longueur du dispositif 10 et de l'alésage 9 sont choisis pour former une chambre de prémélange 20 au fond de l'alésage. L'alésage 9 se prolonge axialement par un canal circulaire 22 jusqu'à un trou latéral borgne 23 servant à recevoir un robinet-poussoir qui commande l'admission et l'arrêt des

fluides formant le spray.

Les canaux 24 et 25 sont percés dans la partie postérieure du corps 2 et se terminent dans le trou borgne 23, d'une part, et dans la surface arrière par un alésage fileté 24A, 25A d'autre part. Ces alésages 24A, 25A servent à recevoir un raccord vissé avec un tuyaux flexible (non représenté) qui mène au boîtier de l'appareil. Les canaux 24 et 25 sont en général symétriques par rapport à un plan vertical comprenant l'axe de la poignée, et le canal 24 est prévu pour l'eau et le canal 25 pour l'air.

Finalement, ces raccords d'eau, d'air et d'électricité sont couverts et protégés par le capot 3 qui s'emboîte sur la partie postérieure de la poignée comportant un rétrécissement 26.

On voit que la poignée 1 est d'une construction en monobloc solide, rigide et robuste, et qu'il n'y a pas de pièces qui doivent être raccordées ou emboîtées, voire positionnées, par l'utilisateur qui veut se servir de l'appareil.

La fig. 3 montre le dispositif d'atomisation selon l'invention qui est utilisé avec l'appareil qui vient d'être décrit mais qui peu servir, indépendamment de celui-ci, à toutes les utilisations où l'on doit produire un spray ultra-fin, régulier et ne demandant que le minimum d'air comme fluide de propulsion. Il peut notamment être utilisé dans toutes les bombes à aérosol connues.

Ce dispositif 10 comprend un corps principal cylindrique 11, agencée pour être vissé dans un alesage

au moyen d'un filetage extérieur 12 et d'un écrou 13; cependant, ces moyens de fixation peuvent être remplacés par l'autres équivalents, selon le cas particulier; l'homme du métier est familier avec ces fixations.

La partie antérieure frontale du corps 11, à gauche dans la fig. 3, comporte un rebord circulare 14 d'une hauteur d'environ 0,1 à 0,2 mm, typiquement 0,11 mm, et un filetage extérieur 15. Un capuchon 16 est vissée sur ce filetage 15 jusqu'a ce que sa face intérieure plane entre en contact avec le bord antérieur du rebord 14. Il se forme donc à l'intérieur du capuchon 16 une chambre de turbulence 21. Une ouverture 17, d'un diamètre adapté au débit du spray désiré, est pratiquée dans la paroi frontale du capuchon 16. Son diamètre qui détermine la forme et le débit du spray, est par exemple de 0,35 mm, pour l'utilisation visée en particulier ici. Cependant, par un essai simple et rapide, l'homme du métier peut trouver un autre diamètre adapté à un autre débit et/ou à d'autres dimensions du dispositif.

Il est très important que les bords circulaires de l'ouverture, en particulier le bord interne, soient francs et nets et que la paroi cylindrique de l'ouverture forme un angle de 90° avec les deux faces parallèles planes du capuchon, c'est-à-dire que l'ouverture est cylindrique dans l'axe du dispositif et sans bord arrondi ou arêtes. Ces conditions sont importantes pour l'atomisation du liquide.

Un, deux ou plusieurs canaux 18 relient la chambre de turbulence à l'extrémité arrière du corps 11. Ils servent au passage d'un prémélange de liquide et d'air provenant d'une chambre de prémélange 20 qui se trouve

derrière le dispositif 10, voir la fig. 1. Le diamètre et le nombre des canaux 18 sont tels qu'une différence de pression est créée entre les deux chambres 20 et 21. Dans l'exécution représentée, il y a deux canaux 18 ayant chacun un diamètre de 0,8 mm. Mais un canal suffit en principe; il ne doit pas être situé dans l'axe du dispositif.

Lors de l'utilisation pour former un spray, la chambre 20 est alimentée, selon la fig. 1, par le canal 22, en air et en eau. La pression de l'eau et de l'air qui entrent dans les alésages 24A et 25A, respectivement, peut atteindre quelques bars; dans l'exemple choisi, elle est de 0,4 bar environ. Un premier mélange, dans un courant plus ou moins laminaire, d'eau et d'air se fait dans le canal circulaire 22 et dans la chambre de prémélange 20. Le mélange final est effectuée à l'état turbulent dans la chambre 21, et un spray parfaitement stable, aux gouttelettes extrêmement fines et régulières, sort de l'orifice 17. L'angle d'ouverture du spray conique est de 5 à 30°, selon le rapport longueur: diamètre de l'ouverture 17. Le débit en eau est d'environ 15 à 20 ml/min, le débit en air est très faible et probablement inférieur à 100 ml/min.

Le dispositif d'atomisation est vissé par devant dans alésage 9 de la poignée 1. Il peut donc être facilement enlevé et nettoyé ou remplacé.

L'éponge 6 est imbibée par le liquide du spray pour assurer la conductibilité entre le disque 7 et la peau d'un patient sur laquelle la poignée est appliquée.

La fig. 4 montre, par une coupe arrachée axiale de la partie frontale d'une autre poignée 1A, l'utilisation d'une électrode multiple. La cuvette 5 de la fig. 1

est subdivisée par des parois verticales en deux, trois ou quatre cuvettes 5A à rebord rentrant comprenant chacune une éponge cylindrique 6A et une électrode métallique plate 7A; chaque électrode est reliée par un fil (non représenté) avec le boîtier de l'appareil qui sera décrit plus bas. Cette configuration permet de faire passer un courant entre deux ou plusieurs pôles 7A des cuvettes 5A à travers les éponges 6A imbibées de liquide, et la peau d'un patient. Plusieurs tensions différentes peuvent alors être appliquées.

La fig. 5 représente un schéma fonctionnel de l'appareil selon l'invention.

Une baie 35 comprend une source de courant continu constant 36 et un générateur d'impulsions 37. Ces impulsions ont normalement une forme rectangulaire; l'appareil permet de régler et bien le rapport cyclique des impulsions et bien leur séquence, c'est-à-dire on peut faire alterner un train d'impulsions avec un arrêt d'impulsions. En plus, la fréquence des impulsions peut être réglable indépendamment du rapport cyclique.

Un commutateur 38 permet de choisir ces courants et de les appliquer à l'entrée d'un amplificateur 39 dont la sortie et reliée aux fils 50 et 51. La baie 35 comprend en outre une électropompe 40 aspirant de l'air à travers un filtre 41. L'air comprimé passe par un générateur d'ozone 42 et d'un corps de chauffe 43 dont la sortie est reliée à l'un des tuyaux souples alimentant la poignée 1.

La pression de l'air s'exerce également au-dessus de la surface d'un liquide ou lotion aqueuse 44

qui se trouve dans un récipient 45. Le liquide sous pression passe à travers un régulateur de débit 46 dans l'autre tuyau souple d'alimentation de la poignée 1. Le débit de l'air qui entre peut également être réglé par un régulateur.

La poignée est raccordée à la baie 35 par un raccord rapide connu en soi, non représenté.

Des robinets 47 ou électrovalves permettent dans certains cas de court-circuiter l'électropompe 40, une bouteille d'oxygène ou d'air sous pression peut alors alimenter l'appareil.

Lors l'utilisation de l'appareil, le patient touche une électrode de retour, appelée électrode inactive 52, reliée à l'amplificateur 39 dans la baie 35 au moyen du fil 53.

La tension appliquée au patientest donc flottante, à savoir le niveau zéro peut changer selon les caractéristiques bioélectriques du patient.

Grâce à l'appareil décrit et représenté on peut prodiguer un vaste éventail de soins avec une seule ou plusieurs poignées de distribution coopérant avec un certain nombre d'électrodes, et une seule baie, les poignées étant rapidement interchangeables. Pour chaque électrode on dispose de toutes les rassources des moyens électromécaniques. Par exemple, on peut utiliser l'électrode monopolaire de manière à délivrer simultanément des impulsions et un spray, ou on peut utiliser une électrode biopolaire de manière à délivrer un courant continu et un spray.

Outre la ficilité de manipulation et la diminution de l'encombrement, le dispositif décrit et représenté est d'un coût relativement faible. En effet, en groupant plusieurs fonctions électriques on n'a, par exemple, besoin que d'une alimentation.

L'appareil selon l'invention peut être modifié dans le cadre de ce qui est revendiqué. Par exemple, la forme, la fréquence et l'amplitude du courant appliqué par la poignée au patient peuvent être différentes de celle décrites ici. En outre, la forme de la poignée peut être adaptée aux besoins des soins ou traitements envisagés.

Une modification préférée consiste en la réalisation d'un système d'aspiration du liquide appliqué en spray sur le peau du patient et sur les éponges. En effet, il peut être gênant lorsqu'il y a un excès de liquide sur la peau.

Ce système qui n'est pas représenté sur le dessin car il peut facilement être réalisé par l'homme du métier, comprend un canal traversant la poignée dans le sens de la longueur et aboutissant dans la cuvette 5. Ce canal est relié par un tuyau flixible à une deuxième tête de l'électropompe, à travers un récipent de séparation. L'électropompe peut donc aspirer le liquide en trop et le récupérer. Cette aspiration peut être enclenchée en continu ou de façon intermittente.

0096731

REVENDICATIONS

1. - Appareil pour soins esthétiques et électrothérapeutiques, comprenant une poignée pour la distribution d'une tension électrique et d'un spray, caractérisé en ce que la poignée comporte intégralement une cuvette dans laquelle est montée au moins une électrode active et une éponge pour transmettre la tension de l'électrode à la peau d'un patient, et au centre un dispositif d'atomisation d'un liquide, ce dispositif d'atomisation étant entouré par l'électrode ou les électrodes, la poignée étant reliée par une conduite flexible à une baie renfermant l'alimentation en courant en fluide.

2. - Appareil selon la revendication 1, caractérisé en ce le dispositif d'atomisation est vissé dans un alésage central de la poignée de façon à former, à l'intérieur de l'alésage qui est relié au fond par un canal à la cavité d'une soupape contrôlant l'admission d'un gaz et d'un liquide aqueux sous pression, une chambre de prémélange des fluides.

3. - Appareil selon la revendication 1 ou 2, caractérisé en ce que la conduite flexible reliant la poignée à la baie, comprend des canaux pour un gaz sous pression, un liquide aqueux sous pression, et, pour chaque électrode active, un câble d'alimentation.

4. - Appareil selon la revendication 3, caractérisé en ce que la poignée comporte également un canal d'évacuation de liquide traversant la poignée en longueur entre la cuvette et l'autre extrémité, la dite conduite flexible comprenant en plus un canal d'évacuation relié dans la baie de l'appareil à la deuxième tête d'une

électropompe, la première tête servant à créer les pressions hydraulique et pneumatique.

5. - Appareil selon l'une des revendications précédentes, caractérisés en ce qu'il comprend un ensemble de plusieurs électrodes distinctes dans la cuvette, chaque électrode étant reliée séparément à une source de tension dans la baie.

6. - Appareil selon l'une des revendications précédentes, caractérisé en ce que la conduite flexible est raccordée à la baie par un raccord rapide, différentes poignéespouvant alors être accouplées à l'appareil.

7. - Appareil selon l'une des revendications précédentes, caractérisé en ce que le dispositif d'atomisation est alimenté par de l'air ou de l'oxygène et de l'eau ou d'une lotion aqueuse, les deux fluides étant sous pression d'environ 0,4 bar.

8. - Appareil selon l'une des revendications précédentes, caractérisé en ce qu'il comprend un générateur d'ozone raccordé dans le flux de l'air ou de l'oxygène.

9. - Dispositif d'atomisation d'un liquide au moyen d'un fluide gazeux sous pression, caractérisé par un corps cylindrique traversé dans toute sa longueur par au moins un canal rectiligne, parallèle à l'axe du corps, par une chambre de turbulence sur la partie frontale du corps, la chambre étant fermée vers l'avant du dispositif par une paroi frontale à faces planes et parallèles comportant une

ouverture centrale cylindrique de formation de spray dont la génératrice forme avec les deux faces de la paroi un angle de 90° sans bords arrondis ni arêtes.

10. - Dispositif selon la revendication 9, caractérisé en ce que la paroi frontale fait partie d'un capuchon vissé sur la partie antérieure du corps, la chambre étant délimitée latéralement par un rebord circulaire.

11. - Dispositif selon la revendication 9 ou 10, caractérisé en ce que le nombre des canaux et leur diamètre ainsi que le diamètre de l'ouverture centrale sont choisis de façon à créer une différence de pression entre la chambre de turbulence et la pression d'alimentation en amont des canaux.

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FIG. 1

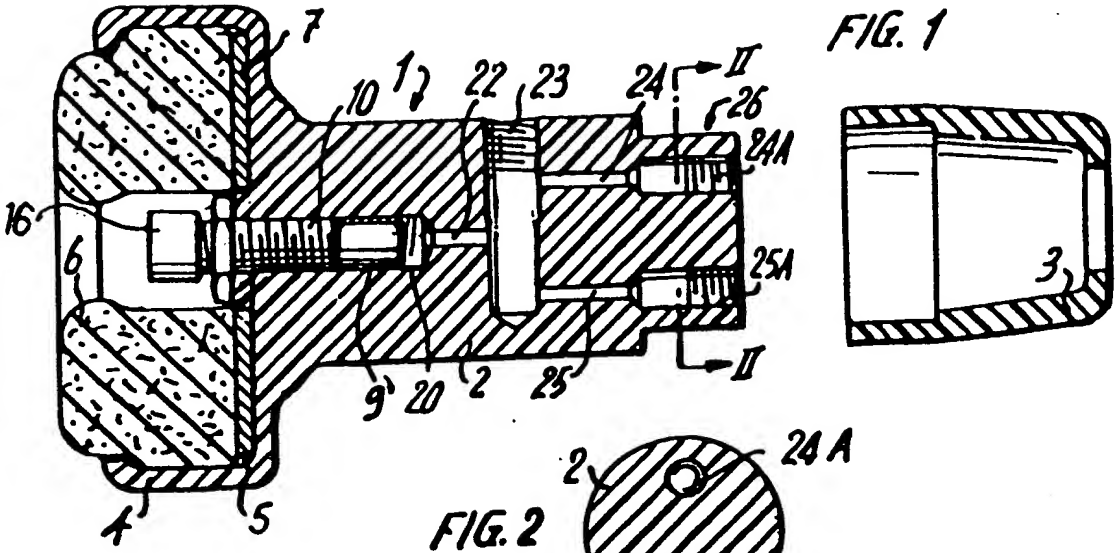
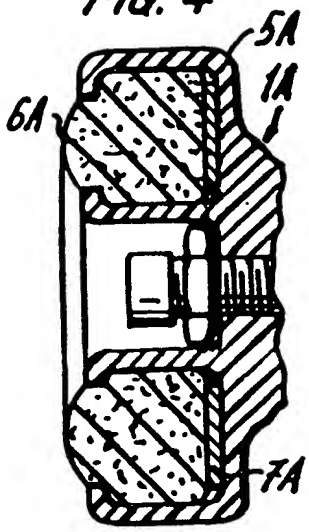


FIG. 2

FIG. 4



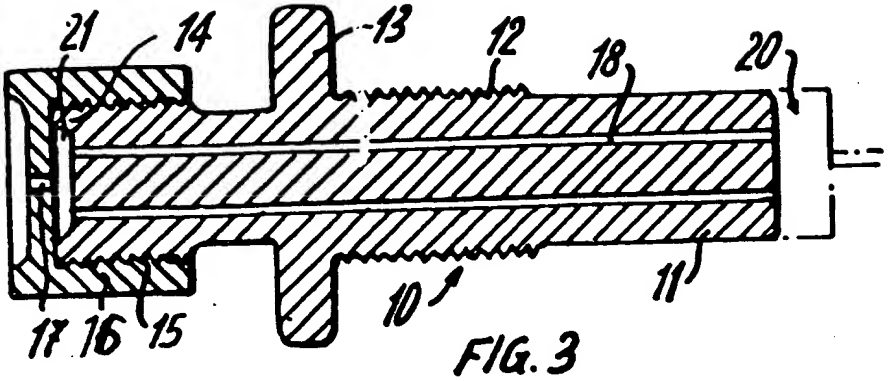
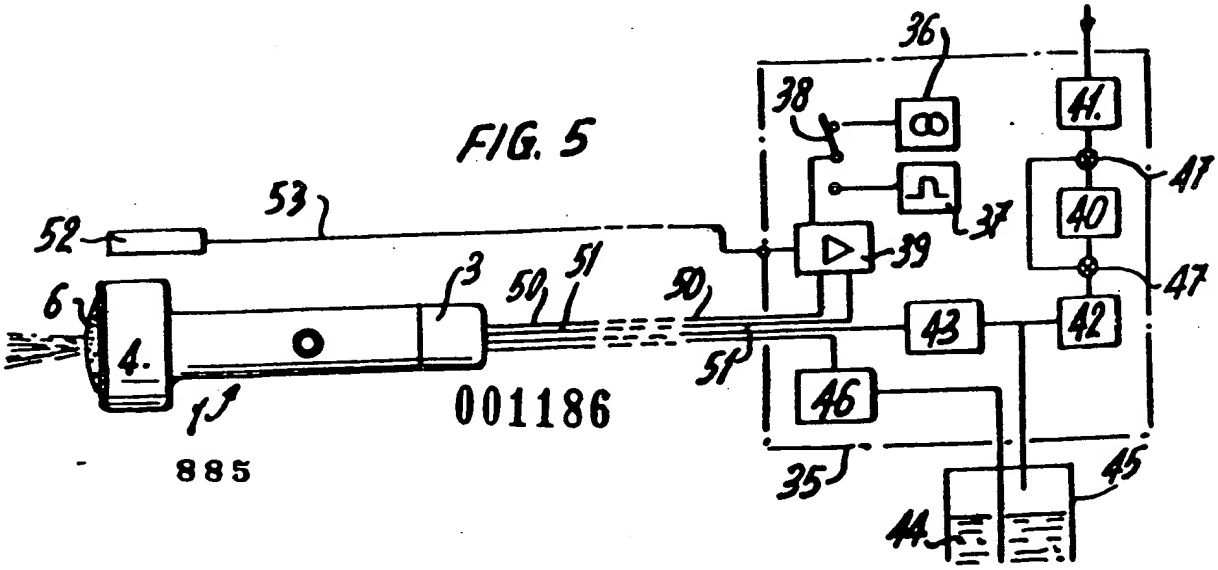


FIG. 3

FIG. 5



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RAPPORT DE RECHERCHE EUROPEENNE

Numéro de la demande
0096731
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DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes	Revendication concernée
X	CH - A5 - 625 959 (BERNAZ) * Entièrmant * --	1,3-7
A	FR - A1 - 2 400 370 (SOMATRON) * Page 1, lignes 1-9; page 2, ligne 24 - page 3, ligne 17 * --	1
A	DE - A1 - 2 411 389 (NEMECTRON) * Page 6, lignes 4-21; fig. 1 * --	1,5
A	US - A - 4 014 345 (KAMEY) * Abrégé; fig. 3 * --	1
A	FR - A - 2 140 948 (BERTHOUD) * Fig. 2 * --	2,9-11
A	DE - A1 - 2 814 246 (METALLGESELLSCHAFT) * Page 6, lignes 11-22; fig. 1 * --	2,9-11
A	US - A - 4 260 110 (WERDING) * Abrégé; colonne 1, lignes 7-29; colonne 14, lignes 12-58; fig. 4 * & FR-A-2 371 238 & FR-A-2 399 282 ----	2,9-11

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CLASSEMENT DE LA DEMANDE (Int. Cl.³)

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CATEGORIE DES DOCUMENTS CITES

X: particulièrement pertinent
A: arrière-plan technologique
O: divulgation non-écrite
P: document intercalaire
T: théorie ou principe à la base de l'invention
E: demande faisant interférence
D: document cité dans la demande
L: document cité pour d'autres raisons

&: membre de la même famille, document correspondant

X Le présent rapport de recherche a été établi pour toutes les revendications

Lieu de la recherche	Date d'achèvement de la recherche	Examinateur
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(71) Applicant : **UNILEVER PLC**
Unilever House Blackfriars
London EC4P 4BQ (GB)
(84) **GB**

(71) Applicant : **UNILEVER N.V.**
Weena 455
NL-3013 AL Rotterdam (NL)
(84) **BE CH DE DK ES FR GR IT LI NL PT SE AT**

(72) Inventor : **Barnett, Philip John**
9 Moorside Avenue
Parkgate, South Wirral L64 6QS (GB)
Inventor : **Lowry, Michael Richard**
46 St Peters Way
Mickle Trafford, Nr Chester CH2 4EJ (GB)

(74) Representative : **Tonge, Robert James et al**
UNILEVER PLC Patent Division Colworth
House Shambrook
GB-Bedford MK44 1LQ (GB)

(54) Skin treatment system.

(57) Skin treatment agents, such as those conventionally found in lotions or creams which are applied by gentle massage or rubbing-in with fingers, are delivered for example in substantially neat form by means of electrostatic spraying.

EP 0 523 960 A1

The present invention relates to a system for delivering skin treatment agents directly to the skin. More particularly, the invention relates to methods and apparatus for applying such agents onto the skin using the principle of electrostatic spraying.

Conventional skin treatment products are often liquid or viscous or semi-solid products, for example in the form of lotions or creams, and are traditionally applied by gentle massage or rubbing-in with the fingers. Because of the necessity for relatively large amounts of adjunct material, i.e. other than the one or more skin treatment actives which it is desired to deposit, to create an aesthetically acceptable product these known delivery systems are relatively elaborate, wasteful of cosmetic raw materials and have limited efficiency in delivering a desired active to an intended site. Control over applied dose is difficult and limited and the application of the product itself is often time consuming and messy.

As a further consequence of the presence in such products of significant amounts of stabilising ingredients such as surfactants, polymers, preservatives etc, sensory properties may often be poor, for example stickiness, greasiness and possibly irritation may be experienced by a user. This may be particularly pronounced where skin is damaged or diseased, in which circumstances application of a treatment agent by massage or rubbing-in will often be particularly undesirable.

The skin is in fact a very complex material and has many important characteristics which must be considered in the design of an optimised system for delivering cosmetic or therapeutic actives thereto. Skin has a multi-faceted surface having both lipophilic and lipophobic character, which for example allows the skin to "breathe" and release water vapour therefrom, yet function as an effective barrier against water, dirt and other unwanted materials. One particularly important physical feature of skin is its very rough surface terrain, which creates a problem in successfully applying a desired skin treatment active with 100% and even coverage.

In addition to the above described systems for delivering skin treatment agents, there are a small number of known examples where a skin treatment active is delivered using an aerosol spray. Two such examples are sprays for treating sunburn and sprains or other sports injuries. However, aerosol sprays, as are per se well known in the art for delivering personal products, also suffer from several disadvantages. For instance, the types of product and active agent which lend themselves to effective aerosol spraying are limited and the use of aerosols themselves still results in significant inefficiency and waste through non-target specific application and loss of active material to the atmosphere, which also results in unwanted atmospheric mists and possible contamination to the user's eyes, face or other body parts, which may present respiratory or other health problems. Aerosol spraying is also noisy and it is usually necessary to employ propellants which are frequently volatile organic compounds, which are now well recognised as being environmentally unfriendly, possibly hazardous to health and indeed are being legislated against in many countries of the world. The use of aerosols to deliver skin treatment agents is also believed to be even less efficient than conventional massage or rubbing-in delivery regimes in the context of percentage and evenness of coverage of the rough skin surface.

In a very different technical field, the principle of electrostatic spraying of liquid and solid materials is also known. In this technique a formulation to be sprayed is raised to a high electric potential in a spray nozzle to cause the formulation to atomise as a spray of electrically charged droplets. Such electrically charged droplets seek the closest earthed object to discharge their electric charge, and this can be arranged to be the desired spray target. Hitherto, electrostatic spraying techniques have been proposed principally for only large-scale industrial and agricultural applications, especially for delivering reactive materials like paints, adhesives and other surface coatings, as well as large-scale delivery of pesticides and other agricultural or agrochemical formulations. Examples of disclosures in this field include GB-A-1393333, GB-A-1569707, GB-A-2092025, EP-A-029301, EP-A-253539 and WO-A-85/00761, the contents of which disclosures are incorporated herein by reference.

More recently, there have been a small number of proposals for utilising the known principle of electrostatic spraying for delivering particular materials in specific applications other than those mentioned above.

EP-A-224352 suggests the use of an electrostatic sprayer for delivering a pharmaceutically active agent to the eye, to replace conventional ocular treatment using eye drops.

JP-A-56-97214 (dating from 1981) suggests the use of electrostatic spraying for applying a granular (i.e. solid particles of) colouring material to hair to effect surface coating thereof.

Also to be mentioned, though of less relevance, is US 4776515, which proposes an electrodynamic fine particle negative ion generator adapted to spray various liquids, particularly water, but possibly also alcohol, perfume, ammonia, liquid medications and surfactants. The object of the disclosed system is to provide an ozone-free mist of negatively ionised liquid particles, (which presupposes that the material to be sprayed is ionizable), and the mist that is produced instantly disperses into an open area in which the apparatus is operated, e.g. a room, so that a far-reaching, uniform aerosol is generated which has particular applicability for large public areas such as hospitals, restaurants and offices. Clearly, this system is unsuitable for small-scale personal use and in many of its objects goes directly against the principles upon which a solution to the above

mentioned prior art problems must be founded.

As a result of identifying and appreciating the above problems, prejudices and limitations of the known art and through much experimentation, we have now devised a system which enables the principle of electrostatic spraying to be put to effective use in delivering skin treatment agents directly to the skin, such that apparatuses and methods are now provided for such delivery regimes which are technically efficient, cost effective, safe, have widespread consumer applicability and appeal, and solve or at least ameliorate many, if not all, of the problems associated with the prior art.

Accordingly, in a first aspect the present invention provides a method of delivering a skin treatment agent directly to the skin, comprising electrostatically spraying the agent thereon.

In more detail, the method of this aspect of the invention preferably comprises:

(a) providing an apparatus which includes

(i) a reservoir containing the skin treatment agent to be delivered which is an electrostatically sprayable form;

(ii) at least one delivery means in communication with the reservoir;

(iii) a high voltage generator powered from an electricity source; and

(iv) control means for selectively applying the high voltage from the generator to the or each delivery means; and

(b) actuating the said control means to electrostatically spray the skin treatment agent from the or each delivery means directly onto the skin at an intended site.

In a second aspect, the present invention provides an apparatus for delivering a skin treatment agent directly to the skin, comprising:

(a) a reservoir for containing the skin treatment agent which is in an electrostatically sprayable form;

(b) at least one delivery means in communication with the reservoir;

(c) a high voltage generator powered from an electricity source;

(d) control means for selectively applying the high voltage from the generator to the or each delivery means to electrostatically spray the skin treatment agent from the or each delivery means.

In a third aspect, the present invention provides, in combination, the apparatus as defined above and an electrostatically sprayable composition consisting of or containing a skin treatment agent to be deposited directly onto the skin.

As a result of our investigations which have led to the present invention, we have further found that the use of electrostatic spraying for delivering skin treatment agents, as compared with the known application regimes, results in some unexpected and surprising findings as regards the effect on the profile of the skin terrain, which have been observed during surface profilometry studies. The unique effect of electrostatic spraying on the skin profile following product application indicates certain additional, unexpected advantages associated with this novel technique, particularly with respect to percentage and evenness of coverage of the skin surface during application. This aspect is discussed in detail further hereinbelow, with reference to the accompanying drawings, in which:

Figures 1(a) to (d) show schematically skin surface profiles of untreated skin and skin treated with treatment agents in regimes in accordance with the present invention and the prior art.

Having thus defined the main aspects of the present invention, preferred embodiments and various optional features and characteristics thereof will now be described in detail.

Skin treatment agents which may be delivered using the system of the present invention can be any of a very wide range of materials, preferably any of those skin treatment materials already known for use in conventional massage or rub-in lotions or cream products. Examples of such skin treatment agents are well known in the art and they may be delivered in accordance with the present invention either singly or in combination.

Examples of suitable skin treatment actives for delivery using the present invention include the following:

1. moisturisers, e.g. 2-hydroxyalkanoic acids, and acid-soap complexes thereof, polyols such as glycerol and glycols, 2-pyrrolidone-5-carboxylic acid, and other emollients or humectants;
2. occlusive materials, e.g. occlusive oils;
3. sun-protective materials, e.g. sunscreens, particularly UV-absorbing sunscreens;
4. after-sun care materials, e.g. materials for treating sunburn;
5. skin conditioning agents, e.g. agents which smooth or soften the skin;
6. skin colouring agents, e.g. artificial tanning products such as compositions containing dihydroxyacetone (DHA);
7. antibacterial or antifungal materials;
8. insect repellents;
9. astringent materials, e.g. hydrolisable tannins, phenolic acids associated with tannins, phenols associated with tannins, flavonoid compounds, natural extracts providing astringency, organic astringents and

inorganic astringents (particularly salts of aluminium, zinc, iron (III), copper or silver);
10. skin cleansers and make-up or other cosmetic removers;
11. massage oils;
12. skin nutrients and healing agents;
13. spot and skin blemish treatment materials;
14. skin whiteners and agents for treating pigmentation disorders, e.g. freckles;
15. antiseptics and disinfectants;
16. anti-ageing agents, e.g. for treating wrinkles or preventing development thereof;
17. agents for treating sensitive skin.

One particular advantage of the products which can be delivered by means of the present invention is that it is possible for at least some of, or even substantially all of, the adjunct components which hitherto have been necessary to include in skin treatment products to be omitted. Thus, it is possible for the required skin treatment active or actives to be delivered in neat or substantially neat form, or with only relatively minor amounts of adjunct materials. Any such auxiliary components, especially solvents or diluents and the like, may however still be used within the scope of this invention if desired or as necessary.

Indeed, for use in the present invention the skin treatment agent(s) is preferably provided in the form of a composition comprising one or more solvents or diluents which solubilise or are soluble in or miscible with the skin treatment active. Suitable solvents are well known in the art and include for example alcohols or polyols such as ethanol, isopropyl alcohol, propylene glycol, dipropylene glycol, phenyl ethyl alcohol, glycerol, 1,3-butanediol, 1,2-propanediol, isoprene glycol.

Compositions to be delivered using the present invention are preferably liquids. Any conventional adjunct materials which are present are preferably also liquid at room temperature, though may optionally be solids if used in minor amounts and do not deprive the composition of being electrostatically sprayable.

Generally there is the essential overall requirement of compositions useful in the present invention that they be electrostatically sprayable.

A principal characteristic of such electrostatically sprayable materials or compositions which it will usually be necessary to carefully select or adjust as necessary (as discussed further below), is their resistivity. Preferred resistivities fall within the range from about 10^4 to about 10^{12} ohm cm, more preferably from about 10^6 to about 10^{10} ohm cm. Resistivities of lower than 10^4 may possibly be used. Resistivities of more than about 10^{12}, e.g. up to about 10^{14} or more, may also be used, though such values are difficult to measure using cheap, conventional resistance measuring apparatus. Resistivity is measured using standard, conventional apparatus and methods, generally at 25°C.

Preferably compositions for delivery using the present invention are non-aqueous or may contain only a small amount of water, e.g. less than 10% by weight, preferably less than 5% by weight, even more preferably less than 1% by weight. This is because, due to its low resistivity, a predominantly aqueous composition is generally difficult to spray effectively using electrostatic means.

Generally compositions for application to the skin in accordance with the present invention will be leave-on compositions, so it will be generally preferred to exclude from compositions for application any components which are disadvantageous in that respect and may impart deleterious effects on the skin when applied thereto and left on.

As mentioned above, depending upon the composition or material to be delivered, it may be necessary to adjust its resistivity by addition of one or more resistivity adjusting materials, examples and suitable amounts of which will be either known to persons skilled in the art, or readily derivable by simple experiment. Suitably, polar substances such as alcohols, e.g. ethanol, may be used to lower the resistivity of a given material or composition, whereas non-polar substances, e.g. oils and other hydrophobic materials, may be used to increase its resistivity. Alternative resistivity adjusting materials include charged species such as salts, e.g. sodium chloride, or a salt conventionally used in buffers in personal products or pharmacological formulations.

In addition to resistivity, another parameter of the compositions to be sprayed which it may be necessary to carefully select and adjust is viscosity.

Materials of a wide range of viscosities may be suitable for use in the present invention, but suitably the viscosity is in the range of from about 0.1 to about 50000 mPas, more preferably from about 0.1 to about 10000 mPas, even more preferably from about 0.5 to about 5000 mPas (at 25°C). If desired or as necessary one or more viscosity adjusting agents may be included. Examples of such agents include salts, e.g. alkali metal or ammonium halides, polymers and conventional thickening materials and oils and polar oil thickeners such as cosmetic oils, waxes, glycerides and suitable amphiphiles with melting points of from example >20°C.

Viscosity may in fact be used as a parameter to control the rate of delivery of the benefit or treatment agent to the intended site, if, as has been found with some embodiments of the system of the invention, it has a substantially inverse proportionality relationship with the flow rate of the material from the delivery means. For ex-

ample, a particular delivery regime or a habit or need of a user may dictate an optimum delivery rate of the particular benefit or treatment agent being applied, in which case careful selection of the viscosity of the material to be sprayed can provide a self-regulating deposition mechanism.

For use in the present invention, the hardware and electrical componentry and circuitry may be of any suitable construction and design. The art of electrostatic spraying contains many examples of suitable apparatus which may be used in the present invention and such disclosures of such apparatus or particular features thereof may be applied either singly or in combination to the spray systems of the present invention.

Examples of suitable electrostatic spraying hardware include, in addition to those of the prior art references mentioned above, those of the following published references: GB-A-2061769, GB-A-2073052, EP-A-031649, EP-A-132062, EP-A-163390, EP-A-171184, EP-A-234842, EP-A-243031, EP-A-368494, EP-A-441501, EP-A-468735 and EP-A-468736; the disclosures of all of which are incorporated herein by reference.

As will be appreciated by persons skilled in the art, particular constructional features and design and electrical and other operating parameters of such apparatuses may be selected or adjusted as necessary, in the context of the present invention, in accordance with the desired functioning characteristics, as for example dictated by the composition or material to be sprayed and/or the needs or wishes of a user.

Features of the apparatus of the present invention which may be so selected and/or adjusted include for example: voltage generated by the high voltage generator and power source, electric field strength in or in the region of the product delivery means, flow rate of the product to be sprayed from the reservoir to and out of the delivery means, size and configuration of the delivery means itself and construction and properties of any product feed mechanism utilised between the reservoir and the output of the delivery means.

In preferred embodiments of the invention, preferred voltages generated by the high voltage generator from the power source are in the range of from about 2 to about 20 kilovolts, more preferably from about 5 to about 16 kilovolts. The most suitable voltage for a given system may depend upon the product to be sprayed, as well as other parameters, all of which will generally be selected to give an overall optimised system.

Electric field strengths which are responsible for the spraying action of the electrostatic apparatus will be largely dependent upon the voltage applied. However, field strengths may be controlled or adjusted if necessary, for example by changes in nozzle configuration or geometry and/or the use of field intensifying electrodes, which are well known in the art cited above.

Optimum flow rates of material to be sprayed will generally depend upon the composition of the product itself, e.g. upon the concentration of the active ingredient(s) being applied and may be selected appropriately on that basis preferably so as to avoid sensory negatives. Also, as already mentioned with respect to viscosity of the sprayable material, a suitable flow rate may be selected depending upon the particular delivery regime and/or habit or needs of a user. By way of example, preferred flow rates of compositions for delivery in accordance with embodiments of the invention are in the range of from about 0.00001 to about 0.5 ml/sec, more preferably from about 0.0001 to about 0.1 ml/sec, per delivery means.

The size and configuration of the one or more delivery means in the apparatus of the invention may be of any suitable form and again may be selected in association with other parameters to give an optimised functioning electrostatic spray delivery system. Commonly the or each delivery means will be in the form of a nozzle, preferably of insulating or semi-insulating material such as plastics or various polymers, as is well known in the art.

In one preferred form of nozzle, a conduit for carrying the product to be sprayed terminates in an orifice at the tip of the nozzle, from which orifice the product is ejected for example initially as a ligament but in any event eventually dispersing as a spray of charged droplets. The orifice preferably has a diameter of not greater than about 400 microns, more preferably not greater than about 350 microns. Even more preferably the orifice has a diameter of between about 125 and about 250 microns.

In an alternative preferred form the nozzle has a crown-like configuration at its tip and includes a narrow conduit through which the product is drawn to the tip under capillary action, as disclosed in EP-A-0243031, the disclosure of which is incorporated herein by reference. In this arrangement the electric field strength at the plurality of projecting portions of the nozzles is sufficiently large compared with the remaining edge areas of the nozzle to cause product to be electrostatically projected from the tip of the nozzle at each of those plurality of locations thereon.

The delivery means may advantageously include metering means to provide a dosing mechanism for delivering a predetermined fixed amount of material from the or each nozzle. Such an expedient may for example be useful in conjunction with a system having a controlled flow rate.

In preferred embodiments of the apparatus of the invention, the or each delivery means is in communication, i.e. preferably fluid communication, with the reservoir or reservoirs (if for example more than one material or composition is to be desired to be sprayed from the same apparatus or even the same delivery means) by virtue of product feed means.

In one preferred form, such feed means may comprise a wick, e.g. a porous wick, through and/or over which the product to be sprayed flows before reaching the point of high electric field strength where it is dispersed as a charged spray of droplets or particles. In another preferred form the feed means may comprise a hollow conduit through which the composition passes under the effect of capillary action. As a further alternative, in systems which for example require a particularly high flow rate, special feed means may be provided, for example a pump, which may usefully be employed with either of the other types of feed means described above. The pump may be of any suitable type, e.g. electrically operated, but more conveniently it may be a simple mechanical device which exerts pressure on the reservoir containing the composition to be sprayed, such that the composition therein is forced out of the reservoir to the delivery means.

As is well known in the art, the apparatus according to the invention preferably include a trigger (i.e. a manual control means) or alternatively an automatic control means to selectively apply the high voltage from the generator to the or each delivery means to electrostatically spray the benefit or treatment agent onto the hair and/or scalp. Any other suitable control means however, e.g. which automatically control actuation of the system, may be used, as will be appreciated by persons skilled in the art.

Skin surface profilometry studies

Skin surface profilometry was used to investigate the effects of applying liquid cosmetic compositions to skin in vivo, specifically to compare the effects of application regimes of the prior art (rub-in and pump spray) and of the present invention (electrostatic spray). Skin surface profilometry techniques and principles are described for example in the following two references, the disclosures of both of which are incorporated herein by reference:

1. "Topographies of dry skin, non-dry skin, and cosmetically treated dry skin as quantified by skin profilometry", T.H. Cook & T.J. Craft; J.Soc. Cosmet. Chem., 36, 143-152 (1985);
2. "Assessment of skin conditions using profilometry", Peter L Dorogi & Marek Zielniski; Cosmetics & Toiletries, 104, (March 1989).

The following product application regimes were investigated:

(i) finger application/rub-in;

(ii) atomised droplets from a pump spray;

(iii) electrically charged droplets from an electrostatic spray.

Experimental

A silicone rubber impression material (SILFLO (TM), ex Flexico Developments Ltd.) was used to obtain negative replicas of the skin surface before and after product application. Replicas were taken from the volar forearm using a maximum of three sites per arm (each site 4x3 cm). The sites were separated by 2-3 cm and were a minimum of 4 cm distance from the wrist and the mid-arm fold. Each site was equilibrated for 15 min. at 21°C/50% relative humidity before replication.

A SURFCOM 113B profilometer from Advanced Metrology Systems Ltd. was used to characterise the replica surface. A stylus of 5µm radius was made to traverse horizontally over a specimen surface with a stylus force of 0.4g. The vertical movement of the stylus was measured and accumulated data was converted electronically to give standard roughness parameters. Measurements were made at 45 degree intervals of sample rotation and the mean of eight 10mm long trackings were calculated.

Two parameters are reported:

R_a - the arithmetic mean of vertical variations from a calculated reference line (i.e. variation in peaks and valleys relative to a "mean reference line").

R_{max} - the maximum peak to valley height in the total scan.

Replicas taken before product application were used as controls. Products were applied at approximately 1mg/cm² (normal skin product loading) and 11 mg/cm² (minimum dose from pump spray). Replicas were taken three minutes after product application. A single panellist was used and sequential treatments were separated by three days.

Two formulations were tested:

Product A: 65% DC344 (silicone oil ex Dow Corning) 5% ESTOL 1514 (iso propyl myristate ex Unichema) 30% Ethanol

Product B: a neat fragrance oil.

For the electrostatic spraying regimes in accordance with the invention, two different prototype apparatuses were used, in accordance with preferred embodiments of the invention, one giving a product flow rate of 2 g/min and the other a flow rate of 0.004 g/min. The electrical hardware and spraying parameters of the apparatuses were optimised to give fine, wide sprays in both cases. For the conventional atomised spray regimes, a conventional fine hairspray-type pump spray was used, such as that available from Cope Allman International Dispenser Group.

RESULTS

The results were as follows:

Mean values and % change relative to control

			R_a (µm)	% change	R_{max} (µm)	% change
(a) Low product loading (1mg/cm²)						
Product A	Rub-in	Control	13.8		139.8	
		Treatment	13.2	-4	114.8	-18
Product A	Electrostatic spray 1*	Control	12.2		124.8	
		Treatment	15.8	+30	159.2	+28
Product B	Rub-in	Control	17.4		212.6	
		Treatment	13.4	-23	136.8	-36
Product B	Electrostatic spray 2**	Control	12.2		171.6	
		Treatment	12.8	+5	148.4	-14
(b) High product loading (11mg/cm²)						
Product A	Pump spray	Control	11.8		112.6	
		Treatment	14.6	+24	185.2	+64
Product A	Electrostatic spray 1	Control	13.8		142.0	
		Treatment	14.0	+1	156.6	+10

* Flow rate 2 g/min

** Flow rate 0.004 g/min

CONCLUSIONS

The surface of skin exhibits a hierarchy of features involving furrows and micro-furrows as described in reference 2. mentioned above. The roughness parameters R_a and R_{max} provide a quantitative description of this complex surface.

The effects on the roughness parameters of product deposition by various application regimes can be envisaged as falling into various categories, as illustrated by Figures 1(a) to (d) of the accompanying drawings, viz:-

Figure 1(a) represents an untreated skin surface, wherefrom control values for R_a and R_{max} are defined;
Figure 1(b) represents even product coverage, with R_a and R_{max} undergoing little or no change;
Figure 1(c) represents predominantly valley coverage, with R_a and R_{max} being significantly reduced;
Figure 1(d) represents predominantly peak coverage, with R_a and R_{max} being significantly increased.
In the light of the above model, the reduction in R_a and R_{max} observed after applying product with finger/rub-

in is consistent with the behaviour shown in Fig. 1(c), i.e. predominant filling of the valleys, leaving the peaks relatively uncovered.

The conventional pump spray, tested only at the high product loading, increased R_a and R_{max}, indicating predominant peak cover (Fig. 1(d)).

The electrostatic applicators according to the invention produced a different response. At low product loading, product A increases R_a and R_{max}, suggesting the behaviour shown in Fig. 1(d), i.e. predominant coverage of peaks. At the higher product loading, R_a and R_{max} were little affected, indicating coverage of both peaks and valleys, i.e. the behaviour shown in Fig. 1(b).

The above results support the finding that electrostatic application regimes as provided by the present invention can provide unique benefits over conventional application techniques for skin treatment products which require 100% and/or even coverage, for example especially where it is required to treat the skin for reasons of protection, conditioning or therapy.

Without intending to be bound by theory, the differences noted between the electrostatically sprayed products appear to reflect differences in product type (with respect to viscosity, wetting ability, volatility, for example) and delivery parameters (droplet velocity, charge, size, for example). The less volatile product B clearly gave relatively good cover even at low product loading, possibly because of higher product capture.

Claims

1. A method of delivering a skin treatment agent directly to the skin, comprising electrostatically spraying the agent thereon.

2. A method according to claim 1, which comprises:
   (a) providing an apparatus which includes
      (i) a reservoir containing the skin treatment agent to be delivered which is an electrostatically sprayable form;
      (ii) at least one delivery means in communication with the reservoir;
      (iii) a high voltage generator powered from an electricity source; and
      (iv) control means for selectively applying the high voltage from the generator to the or each delivery means; and
   (b) actuating the said control means to electrostatically spray the skin treatment agent from the or each delivery means directly onto the skin at an intended site.

3. A method according to claim 1 or claim 2, wherein the skin treatment agent is selected from any one of the following: moisturisers, occlusive materials, sun-protective materials, after-sun care materials, skin conditioning agents, skin colouring agents, antibacterial or antifungal materials, insect repellents, astringent materials, skin cleansers, make-up or other cosmetic removers, massage oils, skin nutrients and healing agents, spot and skin blemish treatment materials, skin whiteners and agents for treating pigmentation disorders, antiseptics and disinfectants, anti-ageing agents, agents for treating sensitive skin, and mixtures of any of the aforesaid materials.

4. A method according to any one of claims 1 to 3, wherein the skin treatment agent is provided in the form of a composition comprising one or more solvents or diluents.

5. A method according to any preceding claim, wherein the skin treatment agent is provided in the form of a composition which has a resistivity in the range 10^4 and 10^{12} ohm cm.

6. A method according to any preceding claim, wherein the high voltage generated by the high voltage generator is in the range 2 to 20 kilovolts.

7. A method according to any preceding claim, wherein the skin treatment agent is in the form of a composition which is sprayed at a flow rate in the range 0.00001 to 0.5 ml/sec.

8. An apparatus for delivering a skin treatment agent directly to the skin, comprising:
   (a) a reservoir for containing the skin treatment agent which is in an electrostatically sprayable form;
   (b) at least one delivery means in communication with the reservoir;
   (c) a high voltage generator powered from an electricity source;
   (d) control means for selectively applying the high voltage from the generator to the or each delivery

means to electrostatically spray the skin treatment agent from the or each delivery means.

9. An apparatus according to claim 8, further comprising product feed means between the reservoir and the or each delivery means for transferring skin treatment agent to the sprayed from the reservoir to the or each delivery means.

10. An apparatus according to claim 9, wherein the product feed means comprises a conduit optionally in combination with a pump.

11. An apparatus according to claim 9, wherein the product feed means comprises a wick.

12. An apparatus according to any one of claims 8 to 11, wherein the high voltage generated by the high voltage generator is in the range 2 to 20 kilovolts.

13. In combination, an apparatus according to any one of claims 8 to 12 and an electrostatically sprayable composition consisting of or containing a skin treatment agent to be deposited directly onto the skin.

14. An electrostatically sprayable composition consisting of or containing a skin treatment agent to be deposited directly onto the skin.

15. A composition according to claim 14, wherein the skin treatment agent is selected from any of the following: moisturisers, occlusive materials, sun-protective materials, after-sun care materials, skin conditioning agents, skin colouring agents, antibacterial or antifungal materials, insect repellents, astringent materials, skin cleansers, make-up or other cosmetic removers, massage oils, skin nutrients and healing agents, spot and skin blemish treatment materials, skin whiteners and agents for treating pigmentation disorders, antiseptics and disinfectants, anti-ageing agents, agents for treating sensitive skin, and mixtures of any of the aforesaid materials.

16. A composition according to claim 14 or claim 15, which comprises one or more solvents or diluents for the skin treatment agent, optionally with one or more conventional adjunct materials found in conventional personal product formulations.

17. A composition according to any one of claims 14 to 16, which has a resistivity in the range 10^4 to 10^{12} ohm cm.

18. A composition according to any one of claims 14 to 17, further comprising a resistivity adjusting agent and/or a viscosity adjusting agent.

19. A composition according to any one of claims 14 to 18, which is substantially non-aqueous or contains only less than 10% by weight water.

20. Use of electrostatic spraying to deliver a skin treatment agent directly to the skin.

21. Use according to claim 20, which employs an apparatus according to any one of claims 8 to 12.

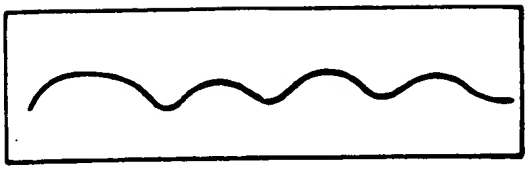

Fig. 1(a)

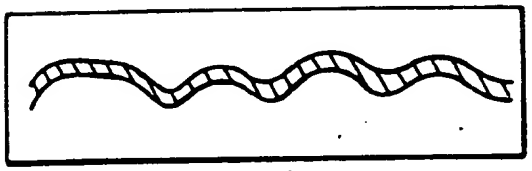

Fig. 1(b)

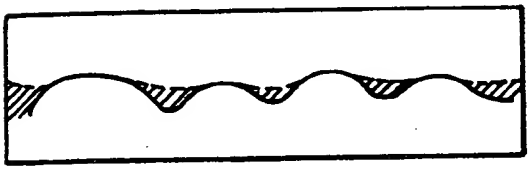

Fig. 1(c)

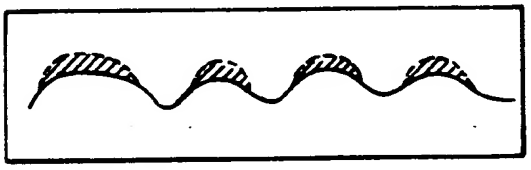

Fig. 1(d)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 92 30 6445

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,X	EP-A-0 224 352 (IMPERIAL CHEMICAL INDUSTRIES PLC.)	1-10, 12-21	B05D1/04 A61N1/44 A61M35/00
X	WO-A-9 000 446 (NATIONAL RESEARCH DEVELOPMENT CORP.) * the whole document *	1-4,6, 8-10, 12-16, 20-21	
X	WO-A-9 003 224 (BATTELLE MEMORIAL INSTITUTE) * the whole document *	1-4, 6-10, 12-16, 18,20,21	
A	DE-C-730 363 (C. RONZI) * the whole document *	1-21	
A	FR-A-735 161 (G.O.E. LETOREY) * the whole document *	1-21	
A	DE-C-108 286 (J.J.STRANDER) * the whole document *	1-21	TECHNICAL FIELDS SEARCHED (Int. Cl.5) A61N A61M B05D
A	EP-A-0 134 951 (BAYER A.G.) * the whole document *	1-21	
A	DATABASE WPIL Section Ch, Week 38, Derwent Publications Ltd., London, GB; Class D21, AN 81-68872D [38] & JP-A-56 097 214 (HOHYU K.K.) 5 August 1981 * abstract *	1-21	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 OCTOBER 1992	BROTHIER J-A.L.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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